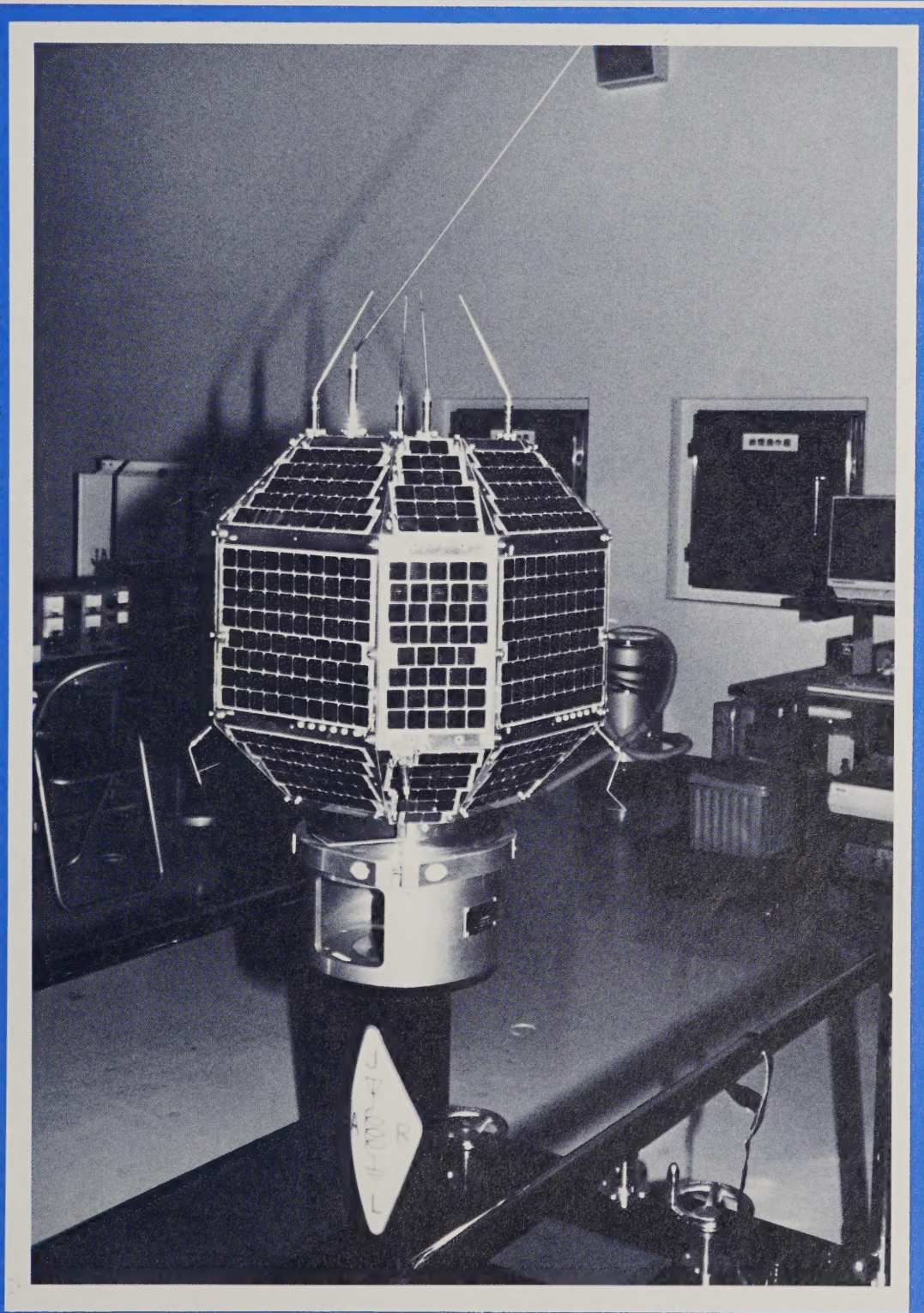
AMSAT

SATELLITE JOURNAL

Journal of the Radio Amateur Space Program

September-October 1985, No. 6



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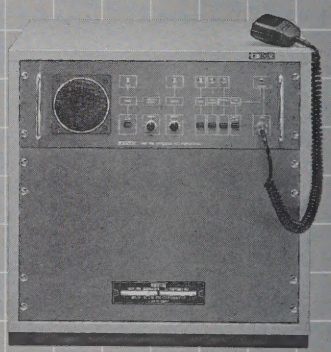

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CONTENTS

On the cover: JAS-1 stands ready to make space history as the first completely Japanese-built amateur-radio satellite. The spacecraft will carry a Mode J transponder, as well as a packet radio store-and-forward unit.

PERSPECTIVE

As part of an on-going effort to improve all aspects of member services, a publisher was recently appointed for Satellite Journal. Although many people are aware that magazines and newspapers have publishers, strangely enough, few are aware of what a publisher actually does. Since the position Doug Bornstein, WA2JTC/6, has assumed did not exist before, it may be helpful to explain just what Doug will be doing.

Perhaps the best place to start is with an analogy. Consider, if you will, a motion picture. Veteran theatre-goers will recall that two names scroll across the screen before the movie actually begins..the director and the producer. Occasionally they are one and the same, but more often they are two people, each with a very important task in the creation of a movie.

The director does just that..directs. He or she directs the actors in their performance, suggesting various ways the lines can be most effectively delivered. The director will also supervise the movement of the cameras, their angles, distance from the actors, just about everything that goes into creating a visual record of an actor's performance. Included in that are the nuances of lighting, sometimes the nature of the wardrobes, and always the mood and setting for the scene. The director, in short, creates the movie from a cast of actors, a collection of props, a locale, a crew of technicians and cameramen, and whatever inspiration he or she can muster.

On the other hand, the producer might never see the actors emoting, might never set foot onto the set, and may not see the "rushes" until the best of the day's efforts have been spared the cutting-room floor. Although the producer will often take an active interest in the actual production of a film, he will not become involved in what generally is regarded as the creative process.

What does a producer do? Basically he provides the money, services, the equipment, and whatever else is needed for production of the film. He will often solicit the initial capital from investors, hire the staff, buy the equipment, rent the sound stage, procure the remote locations, and supervise the transportation of temperamental actors to some less-than-hospitable surroundings on a desert or to the more pleasant locales of southern California. In short, the producer produces the resources, monetary and otherwise, that makes picture-production possible.

The analogy holds quite true for a magazine. The editor edits manuscripts, writes portions of the magazine, ensures grammatical integrity, and otherwise attends to the creative details of production. The publisher, on the other hand, makes certain that there is money to pay for the services required to print a magazine. Those services include typesetting, printing, and mailing. The money may come from the treasury of the sponsoring organization or from advertising revenues.

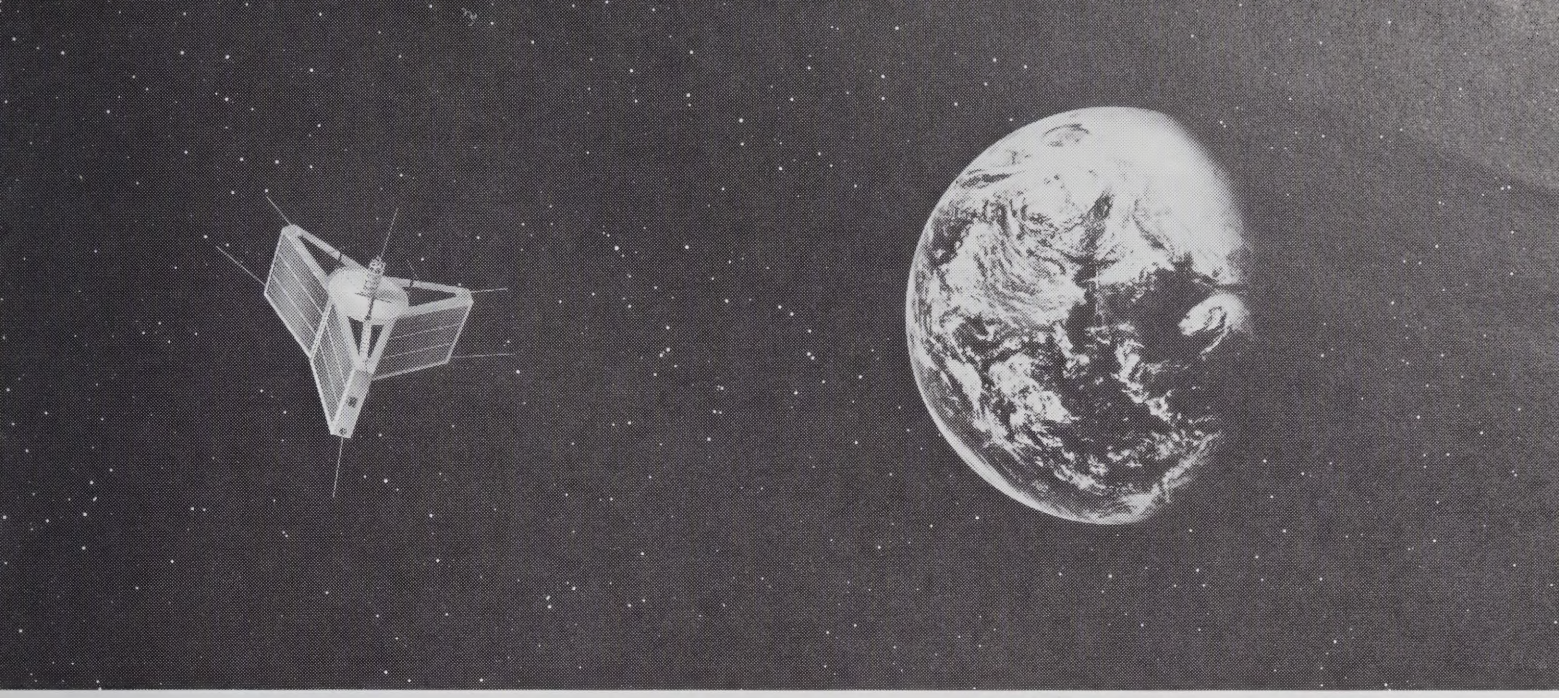
To ensure a self-sufficient publication, one that will not draw from the resources better spent on other member services, the publisher of Satellite Journal has initiated a vigorous advertising program. The measure of his success will be right here in the pages of this magazine. The more ads, the more successful Doug will be in ensuring not only the continuance of an AMSAT publication, but guaranteeing its healthy growth.

Initial response to Doug's efforts has been more than encouraging, it's been remarkable. In upcoming issues you will witness the increasing participation of the amateur-radio retail and manufacturing industry in not only helping Satellite Journal to grow, but in demonstrating the very important economic force that more than 6 thousand satellite enthusiasts represent.

Simply stated, the more advertising pages, the more features, articles, columns, data, photographs, and other items you want to see in this magazine. Help Doug and Satellite Journal by letting retailers know that you saw their ads here. And of course, those advertisers you see within the covers of this magazine are showing their support for the amateur space program. You can return the favor by patronizing them.

Let's all wish Doug the best of luck in his new position. Doug, a young native New Yorker who followed the advice to go west, will be happy to send you a media kit including a rate card. If you would like to contact him, give him a call at the telephone number shown on the masthead or write to him at his California office.

Harold Winard, KB2M



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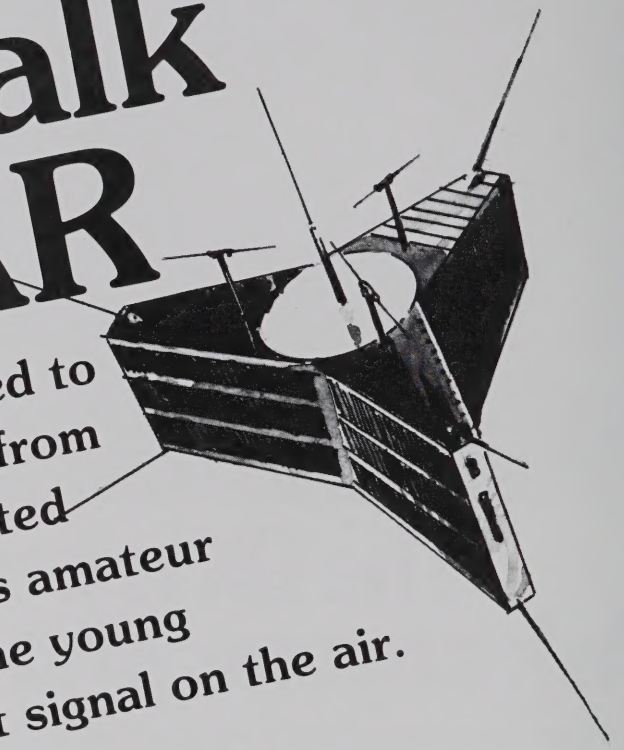

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Starting Out: A Beginner's Guide

By Andy MacAllister, WA5ZIB*

If you have ever earned a low-band award, such as DXCC, you know the thrill of accomplishment when the certificate finally appears in the mailbox. That gratifying feeling can be relived and amplified when you try for some of your favorite awards via satellite. There are also awards that were created specifically for satellites. For the new satellite chaser, and the old hand too, there are a lot of challenges available.

Your first satellite award can be the Phase-3 Satellite Communicators' Club certificate. To earn that award, simply report a two-way contact through AMSAT-OSCAR-10 to AMSAT S.C.C. Manager, P.O. Box 27, Washington, DC 20044. No form is necessary. Just send all pertinent information about the QSO along with an SASE and $1 ($2 for non-members).

Another AMSAT challenge for the newcomer is the K2ZRO Memorial Station Engineering Award. In that test of operating skill and equipment performance, a control station sends and repeats numeric code groups at different power levels. The idea is to measure the receive sensitivity of your satellite station for comparison with other participants. If you can copy the satellite's beacon, you can get started in this program.

The challenge of the K2ZRO award program comes when the satellite enthusiast pursues endoresement stickers for station improvements on both Mode B and Mode L reception. The basic award is $3.50 for members and $5.00 for nonmembers. Further details and operating times can be obtained for an SASE to AMSAT ZRO Test, P.O. Box 177, Warwick, NY 10990.

Once you have started in satellite awards, try the Ten American Districts Award (TAD) with OSCAR endorsement. The award is sponsored by the Lockheed E.R.C. Amateur Radio Club. Send QSL cards confirming contact with a station in each of the ten American callsign areas. Enclose $2 and address the envelope to W6LS, 2814 Empire Ave., Burbank, CA 91504.

Two awards available from the American Radio Relay League look great on any wall: Worked All Continents (WAC) via satellite and the Satellite DX Achievement Award (DX-1000). The popular WAC award is now available for OSCAR-10 contacts and can be yours simply by submitting proof of contact with a station in Africa, Asia, Europe, North America, South America, and Oceania. Don't forget to mention the satellite endorsement when applying.

The rules for the DX-1000 Award are a bit more complicated. To qualify, you must accumulate 1000 points. Each QSO with a new station earns 10 points, each new country is 50 points, and each new continent counts for 250 points. Your first contact therefore earns 310 points. Request form CD-206 when you are ready to apply for the award. There is no fee for either award, but ARRL membership is required of all American and Canadian applicants. Send the cards and return postage to the ARRL, 225 Main St., Newington, CT 06111.

A fine looking certificate from the Northern Alberta UHF Society, called the VE Satellite Award, is available to any licensed amateur. W/VW stations and KL7 must submit QSL cards confirming satellite contacts with eight different Canadian call areas (VE1, 2, 3, 4, 5, 6, 7, 8,

continued on page 16

The Digital Front

by Harold Price, NK6K*

This month: A small chewing out, "Which TNC should I buy," and JAS-1 info.

I don't know whether I should be pleased or distressed. To keep up my image, I suppose I should be distressed. At the recent ARRL national convention in Kentucky, I gave a talk under the general description "AMSAT." Just before rolling into the PACSAT portion, about halfway through, I asked the group of about 40 how many where familiar with packet radio. All but three or four of the audience raised their hands. That, of course, was pleasing. The distressing part had occurred earlier, when I had asked how many were familiar with AMSAT-OSCAR-10. Only five or six people raised their hands.

That means that somebody isn't doing a good job of local public relations. If you're reading Satellite Journal, that somebody is you. I don't want to waste any space here with rah-rah, but let's get with it, gang. I'll take my share of the blame, since I haven't written a satellite article for the other ham magazines recently either. But what we really need more of is word-of-mouth. When a high League official says to me at dinner "Yes, but what is OSCAR-10 really good for," we've got a problem.

"Hey Harold, what TNC should I buy?"

Since I hate to lead people on, let me say up front that I'm not going to come out and say which brand terminal node controller (TNC) you should buy for use with present and future satellites. I'm going to weasel out of that just like everyone else does. I will tell you what attributes you will want your TNC to have, leaving the final shopping up to you. I'll also mention that I'm involved in the software end with TAPR, the Tucson Amateur Packet Radio Association, and its TNCs, so any bias you detect is intentional. After all, if I thought there was a better way to do it, I'd have done it that way, wouldn't I?

Phase III-C (PIII-C), JAS-1, and PACSAT will all carry special hardware to support packet radio activities. PIII-C and JAS-1 are scheduled for launch in the summer of 1986, PACSAT will launch in the following year. All will use AX.25 as the link-level protocol for onboard message storage. Since all TNCs available today support AX.25, that is not a consideration.

The most important feature that your prospective TNC must have is the ability to use an external modem. All of the digital satellites will use modem standards other than the Bell-202 style FSK modem that is used on terrestrial VHF packet networks, so you will need to bypass the TNC onboard modem. You'll need Receive Data (RD), Receive Data clock, Transmit Data (TD), Transmit Data clock, and probably some of the other handshaking signals. TNCs with a connector for this purpose are the AEA PKT-1, AEA PK-80, Heath HD-4040, TAPR TNC 1, TAPR TNC 2. The VADCG TNC always uses an external modem. The AEA PK-64 has provisions for an external HF modem, I haven't seen a production version yet, so I don't know if the clock signals are easily accessible.

The next feature your TNC will need is the ability to send and receive data through its external modem at speeds greater than 1200 bits per second (bps). PACSAT will use 4800 or 9600 bps, PIII-C will use 2400 bps for its uplink. Most of the TNCs named above will handle these speeds, check with the vendor.

For PIII-C, you will need to be able to transmit at one baud rate and receive at a different baud rate. PIII-C will uplink at 2400 bauds and downlink at 400 bauds. Again, most of the TNCs named above will permit external input of the receive and transmit clocks.

Finally, you will want to have a TNC with full duplex capability. The satellites are all crossband, and most user stations have full duplex RF capability. PACSAT will accommodate both full and half duplex data users; I don't know what is planned in this area for PIII-C and JAS-1. In any case, the most efficient data transfer mode is full duplex, and in a 10-minute low-earth-orbit pass you need all the efficiency you can get.

I can already hear the question, "Why don't all of the satellites use the same modem standard?" The answer is in the different goals and operating environment of each satellite. A real-time relay satellite at 33,000 km is different than a store-and-forward satellite at 800 km.

Standardization will hopefully occur at the TNC/modem interface. It appears that all of the modem development groups are considering the signals available at the external modem connector on the TAPR TNC 1 and 2 (and AEA PKT-1/PK 80 and Heath 4040) as a standard. This is also the standard in use for terrestrial-network modem design, most notably the K9NG 9600-bps modem. The subject will be brought up at the AMSAT General Meeting in November. Hopefully, the international community can agree on a standard for a "black-box" modem to fit between the TNC and radios. Future columns will provide more detail on each satellite and its digital access modes.

JAS-1

Some detail on JAS-1, the Japanese amateur radio satellite, is already available. Most of the following

information was obtained over a packet link with Tac, N6MBM. Tac is a JA ham, currently living in southern California. He has been gathering and translating information from JRRL and JAMSAT on the JAS-1 project.

JAS-1 will use 1200 bauds for both the uplink and the downlink. Data will be exchanged using Manchester encoding for the uplink and phase shift keying (PSK) for the downlink. The uplink will require a frequency-modulated RF signal, the downlink will necessitate a single-sideband receiver.

The digital transponder on JAS-1 will transmit with 1 W, the ground station will need to transmit 50 to 100 W EIRP. The digital transponder (JD mode) is 70 cm up and 2 meters down.

The design of a simple modem has been completed, and development of an improved second-generation modem is currently underway by JA1TUR. The simple modem uses eight chips, none of them exotic. The ground receiver currently must be within 200-to-300 Hz, this is a major target of the improvement. The modem is designed for the TNC 1/TNC 2 external modem connector. Both TNC 1 and 2 are being used for testing, in addition to TNCs of JA design.

The JAS-1 User's Guide is currently being translated into English; watch the Digital Front for more information when it becomes available. The flight hardware for JAS-1 has been completed, and we can expect the JA hams to give us all something new to do in the fall of 1986.

Shuttle packet

We may also see a TNC in space by the spring of 1986. Tom, W3IWI, having unloaded his AMSAT administrative duties last year, is back in the technical side of the house in a big way. He has a cattle prod out and humming, getting a large group of fellow AMSAT ~~slaves~~ volunteers running to beat a deadline to get packet on the next ham-in-space mission. More news next issue, on Beat the Clock.

*1211 Ford Avenue
Redondo Beach, CA 90278

de K2UBC

by Martin R. Davidoff, K2UBC*

Writing scientific papers, I don't often get a chance to say "Wow!, Super!," or "Extraordinary!," but I need those terms now to describe my reactions to a new IBM PC/PCjr software tracking package put together by Roy Welch, WØSL. Yes, it's fast. Yes, it has a great many features. But it's the graphics capabilities that impress me most.

In the graphics mode, the WØSL program shows the positions of several satellites superimposed on a Mercator-projection-type map. The location of each spacecraft, that is the subsatellite point, is updated in real time. You feel you're watching the satellite move over the earth. That makes it easy to keep track of several spacecraft simultaneously with very little conscious effort. The result encourages a whole new approach to operating.

Experimenting with the program, I couldn't help but let my imagination take over . . .

It's late in 1986. You enter the shack, flip on the computer, and see that Phase III-C is in range so you fire up the rig and QSO a KH6. After a while you note from the monitor that Shuttle STS 62-K is approaching. Access is due in a few minutes so you pass along your 73s and QSY to try for a QSO. But, as it comes into range you hear the automatic amateur beacon indicating that operation this pass will be limited to downlinking slow-scan TV..no two-ways. Just as you being to feel that this isn't your day you notice out of the corner of your eye that a descending RS-8 pass is imminent and it might be suitable for the W3-to-KH6 QSO that you need to complete satellite WAS using low-altitude spacecraft only. So you quickly break the KH6 on Phase III-C to arrange a schedule. As soon as you hear your signal coming from RS-8 you give a two-by-two call. The response is immediate and 20 seconds later the QSO is history. Time to take the kids to the movie so you reconfigure your station (i.e., flip a few switches) and everything is set to automatically collect your PACSAT mail while you're gone.

Back to reality. This column is obviously not a software review. What I've tried to do is to show how a powerful new tool, like the WØSL program, can have a significant impact on the way a radio amateur operates. To use the graphics part of the WØSL package you need an IBM PC with a color graphics video board and either a color or monochrome monitor. You'll also need at least 128 kbytes of RAM and one disk drive. If your IBM computer only has a monochrome video board, you can still use the package for tracking since it includes an updated version of the original W3IWI tracking program. However, you will have to make some small changes in BASIC and you won't be able to use any of the graphics.

Copies of the WØSL program can be ordered from AMSAT, P.O. Box 27, Washington, DC 20004. The cost for AMSAT members is $20 ($25 for others). Outside of North America there's an extra $2 fee for airmail delivery. If you have a PCjr be sure to specify the special PCjr version.

The regular version appears to work okay on many compatibles, including the Tandy 1000, Heath/Zenith 150, Televideo, AT&T 6300, and Columbia Data Products. Minor changes are required for the IBM PC/AT and Compaq.

The documentation for the WØSL program exists on three levels. Level 1 consists of a manual containing an overview and introductory material; Level II consists of numerous menus and prompts throughout the programs; Level III contains remark statements in the BASIC code.

The instruction manual is on the disk. One of the first things a new user must do is print it out. Anyone who has had a little experience running public domain programs on their computer will find the documentation for the WØSL program clear and easy to use. It should only take 15 minutes to have the program up and running, most of the time spent waiting as the printer hammers out seven single-spaced pages of information. However, if you're a real novice in the area of computers you many have some trouble getting started. I'd like to discuss why this is so and offers some suggestions to ease the pain.

With any new computer, the user must learn how to accomplish a few fundamental operations. These include initializing (also called formatting) a new disk so it can be used by the computer, copying a disk, loading the BASIC language, loading and running a BASIC program, instructing the printer to echo information appearing on the screen, etc. With the IBM PC, directions for accomplishing those tasks are repeated in several of the manuals that come with the computer. Since this information is readily available, authors of AMSAT software do not repeat it. Now, anyone struggling to get things running would certainly like to have some step-by-step directions. But, think about the poor author who's spent hundreds of hours getting the program operating and then donated all that work to AMSAT. Is it fair to ask that person to now rewrite big chunks of the IBM manuals?

If you're having trouble getting started, dig out the instruction manuals that came with your computer and read the sections that describe how to format a disk, load and run a program written in BASIC, duplicate a disk (diskcopy), obtain a directory of programs on a disk, and direct the printer to echo information appearing on the monitor by simultaneously pressing the Control (Ctrl) and Print Screen (PrtSc) keys. Practice these opera-

continued on page 14

What's Your Opinion?

Do you have an opinion on some aspect of the amateur-radio space program? Would you like to share it with other space enthusiasts? Send your opinions, typewritten and double-spaced, to Satellite Journal, P.O. Box 575, Wharton, NJ 07885. To give as many people a chance to have their thoughts put into print, please limit yours to one or two paragraphs.

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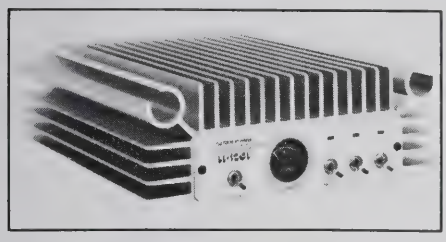
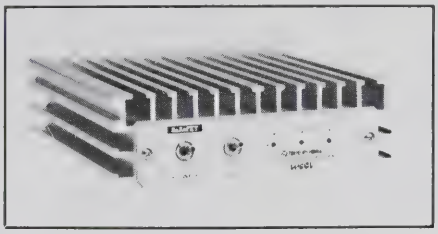
UHF AMPLIFIERS

HL-120U



HL-60U



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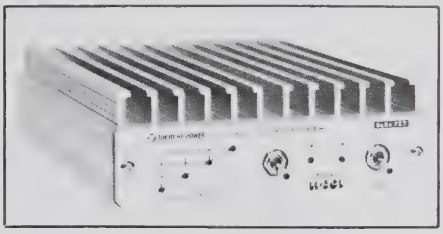

MODEL	HL-120U UHF SSB/FM/CW AMPLIFIER 100 WATT	HL-60U UHF SSB/CW/FM AMPLIFIER 60 WATT	HL-30U UHF SSB/CW/FM AMPLIFIER 30 WATT	HL-20U HUF SSB/FM AMPLIFIER 20 WATT	HL-30V VHF FM AMPLIFIER 25 WATT
Sugg. Retail	$399.95	$249.95	$149.95	$129.95	$76.95
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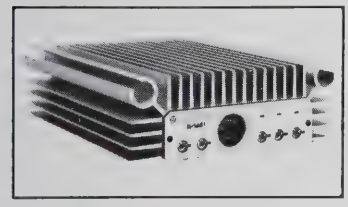
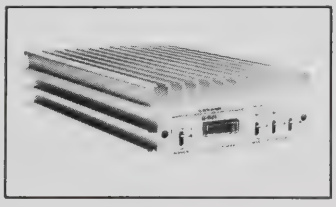
Frequency Range	430-449.995 MHz	430-449.995 MHz	430-449.995 MHz	430-449.995 MHz	144-148 MHz (Export 150 MHz avail)
Modes	SSB, CW, FM, TV	SSB, CW, FM, TV	SSB, CW, FM	SSB,CW,FM	FM
Supply Volts @ Amps	DC + 13.8V @ 17-19 A	DC + 13.8V @ 9 amps	DC + 13.8V @ 5 AMPS	DC + 13.8V @ 4 AMPS	DC + 13.8V @ 4 Amps
R.F. Power-Out (AVG)	100W	50 Watts	30 Watts	20 Watts	25 Watts
R.F. Power-In (NOM)	12 Watts	12 Watts	2 Watts	3W or 100mW (selected internally)	2.5 Watts
Connector In/Out	TYPE 'N'	TYPE 'M'	TYPE 'M'	TYPE 'M'	TYPE 'M'
Pre-amp Type	GaAsFET	GaAsFET	GaAsFET	NONE	N/A
Output Meter Type	LIGHTED METER	N/A	L.E.D.	NONE	N/A
Dimensions	218W x 82H x 299D m/m	150W x 45H x 164D m/m	100W x 35H x 170D m/m	100W x 30H x 158D m/m	100W x 30H x 158D m/m
Weight	3.5 Kg	1.2 Kg	550g	520g	520g

VHF LINEAR AMPLIFIERS

HL-160/V25

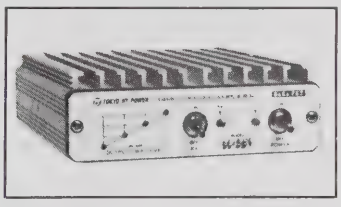


HL-110

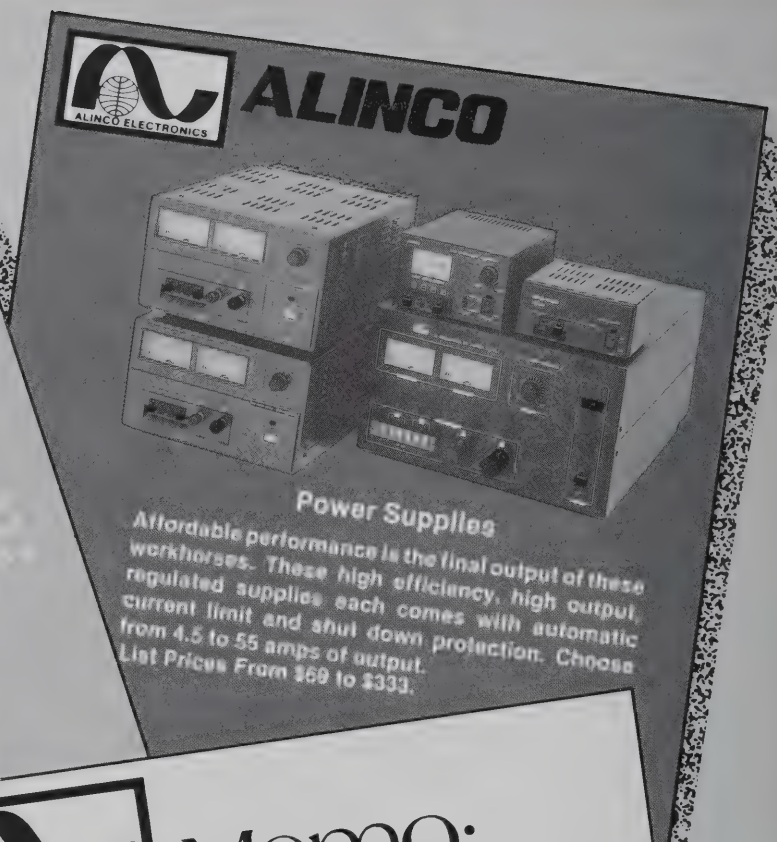


HL-85

HL-35V-L



MODEL	HL-160V and HL-160V25 VHF 160W OUTPUT METER PREAMP	HL-110V VHF AMP 100 WATTS OUTPUT METER PREAMP	HL-85V VHF 80 WATT GaAsFET PREAMP METERING	HL-62V VHF SSB/FM AMP, GaAsFET PREAMP	HL-35V/L VHF FM/SSB AMP 25 WATT GaAsFET PREAMP
Sugg. Retail	$379.95 HL-160V $299.95 HL-160V25	$259.95	$189.95	$169.95	HL-35V $89.95 HL-35V/L $99.95
Description	144 MHz all mode amp with low noise FET type preamplifier. 160 Watts out from 3, 10, Watts with 160V (25 W 160V25)	144 MHz all mode with MOS-FET preamp	144 MHz all mode amp with low noise GaAsFET type preamplifier. 80 Watts Output with 10 W drive.	144 MHz all mode amp with GaAsFET type pre-amplifier.	VHF multi-purpose amplifier for SSB or FM. ECONOMICAL Best Buy in $/Watt with SSB capability and GaAsFET PRE-AMPLIFIER.
Frequency Range	144-148 (Export Available 150-160 MHz)	144-148 MHz	144-148 (Export Available 150-160 MHz)	144-148 MHz	144-148 MHz
Modes	SSB, CW, FM	SSB,CW,FM	SSB, CW, FM	SSB, CW, FM	FM(35V) FM/SSB/CW (35V/L)
Supply Volts @ Amps	DC + 13.8V @ 23A (V25: 22A)	DC + 13.8V @ 15 AMPS	DC + 13.8V @ 12 amps	DC + 13.8V @ 7.5 A	DC + 13.8V @ 4 Amps
R.F. Power-Out (AVG)	160W	100 Watts	80 Watts	60 W	25 Watts
R.F. Power-In (NOM)	3 or 10 (V25: 25W)	10 Watts	10 Watts	10 Watts	2.5 Watts
Connector In/Out	TYPE 'M'	TYPE 'M'	TYPE 'M'	TYPE 'M'	TYPE 'M'
Pre-amp Type	F.E.T.	MOS-FET	GaAsFET	GaAsFET	GaAsFET
Output Meter Type	LIGHTED METER	LIGHTED METER	LIGHTED METER		L.E.D.
Dimensions	218W x 82H x 299D m/m	172W x 60H x 263D m/m	172W x 60H x 184D m/m	150W x 45H x 164D m/m	100W x 35H x 150D m/m
Weight	3.5 Kg	2.2 Kg	2.0 Kg	1.2 Kg	520g



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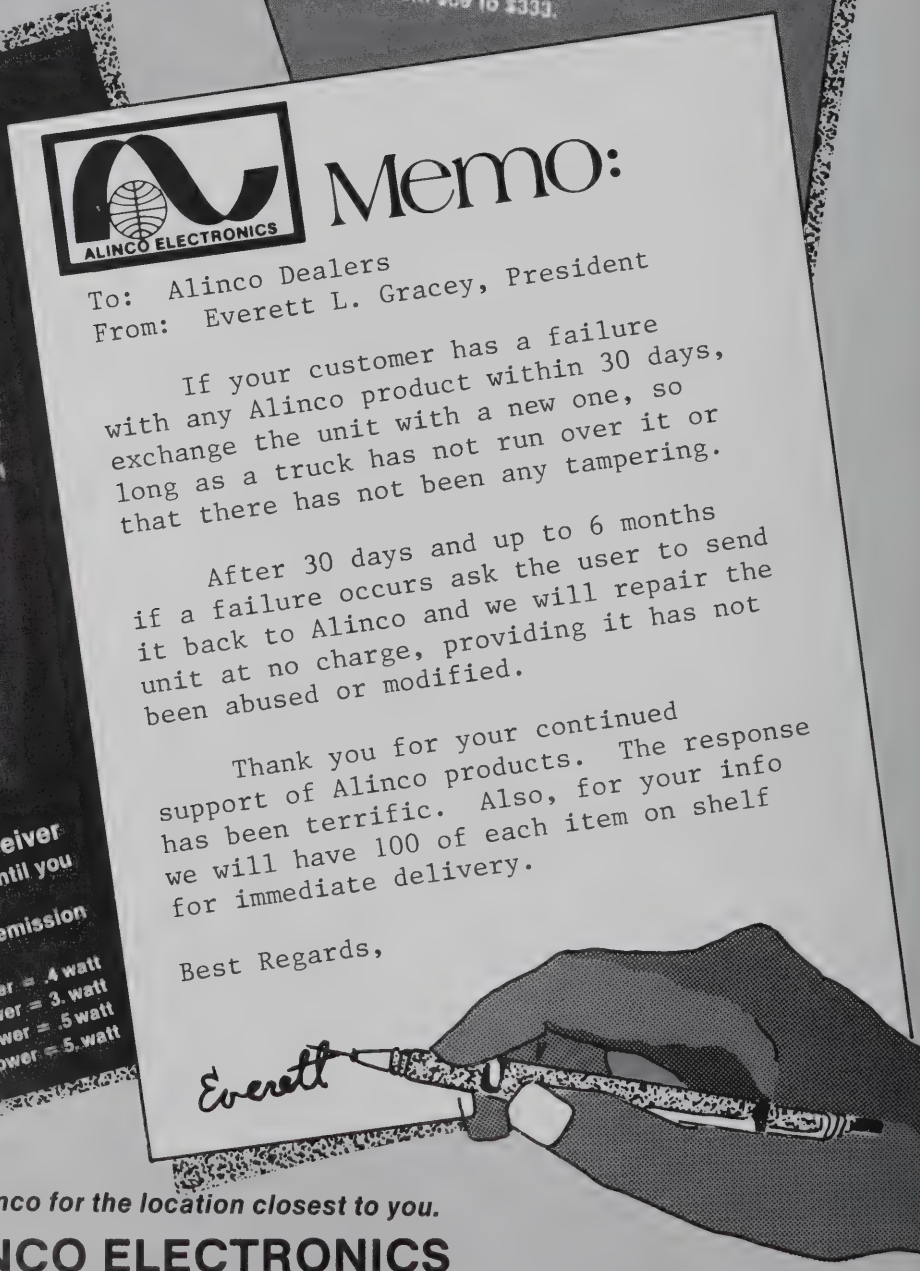

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W 6 Space Philosopher

by John Browning, W6SP, Chairman of the Board*

During routine encounters with others, we are frequently encouraged to "Have a nice day!" Most of us try to comply with the suggestion, even though no one has formally defined specific requirements for experiencing a "nice" day. Nonetheless, we always recognize one when we see it. On such occasions, everything seems to go right. Everybody's performance exceeds expectations. Pieces of the puzzle fall into place. Progress is achieved. We have enjoyed a day worth remembering

On especially nice days, our satellites are placed in orbit. June 16, 1983 (AMSAT-OSCAR 10) and March 1, 1984 (UOSAT-OSCAR 11) are thus remembered. On other nice days, incremental progress toward launch readiness is evident. Sometimes, improved utilization of orbiting spacecraft is achieved. Nice days are encountered whenever good ideas are implemented by good people. All of these occasions provide encouragement for our volunteers, who contribute their valuable efforts in behalf of the amateur satellite program

In Satellite Journal (May-June 1985, No. 4) I mentioned the lack of a beginners' handbook for Phase III satellite users. The need for such a document had been clearly established but no one had come forward to perform the task. Before the magazine was distributed, I traveled to Dayton to attend the Hamvention. Much to my surprise and pleasure, I found "A Beginners Guide to OSCAR- 10" available at the AMSAT booth. Mike Crisler, N4IFD, had done an excellent job of coordinating the creation of a publication that provides "complete, simplified, step-by-step instructions and advice on how to get started on OSCAR-10 operation." His handbook was extremely well received at the convention. It has since been refined and is now available in quantity from AMSAT headquarters. Needless to say, April 26, 1985 was a nice day

Mike is a personable lad who lives in Miami, Florida. He was recently appointed assistant vice president of field operations. In that capacity, Mike oversees the functions of more than 100 area coordinators and staff and plays a key role in planning and supporting hamfests and conventions. He has joined the ranks of AMSAT officials, most of whom seem to have only one common characteristic. We vary greatly in age, place of origin, education, talent, and personality, but most of us perform amateur satellite duties in parallel with the pursuit of a professional career. Nearly all our officers are professionals who can somehow accommodate extra travel and other mandatory activities within the constraints of their jobs. We have few retired members serving as officers or in key operational positions

At first glance, one might be surprised to find a paucity of retirees in the management ranks of a dynamic, nonprofit, public-service organization. A little thought provides a logical explanation. Retirement is an individual state of mind. At a specific but variable time in life, most people consciously and deliberately opt for full retirement. A discreet transition from a "routine" to an "ad hoc" operating mode occurs. The new retiree starts functioning on his own schedule. He will no longer commit to obligatory periodic duties. But he will generally be willing to take on worthwhile individual tasks if they do not impact his new independence

Thus, we have an available pool of amateur radio operators positioned to devote extensive periods of time to the handling of emergency traffic following unexpected disasters, large and small. And AMSAT has access to a vast wealth of talent that can be tapped for the purpose of completing important, short-term projects. Many retirees have made major contributions in the past. Many more will contribute in the future. Some may even select the option to come out of retirement!

Certain of my more senior friends are reluctant to recognize the extent of their latent capabilities. Some of them claim to be too old to learn. The truth is, most of the mature amateurs who have plunged into computers or satellite operations have taken to it like a duck to water. Neither activity imposes strict schedule deadlines. However, both tend to be habit forming

About three years ago, I journeyed over to Long Beach, California to visit John Fail, KL7GRF. John is a very busy digital wizard who may never find time to retire. Also present was Vic Ruebhausen, W6WNK, who claims to be taking life easy. Vic is a sprightly chap who has been around for exactly 0.75 century as evidenced by some, but not a lot of, grey hair. Vic was there to get his first computer lesson from John. He had brought along his new Sinclair ZX-81 complete with spreadsheet program. I overheard the following dialogue:

John: "Type in the program name."

Vic: "Done!"

John: "Now enter the program."

Vic: "How do I do that?"

From that humble beginning, Vic has progressed through the development of the VR-80 satellite prediction program for the Sinclair ZX-81, and the Timex TS-1000, -1500, and -2068. He has also produced the VR-85 program for the Commodore C-64 and C-128 models. In addition to providing antenna pointing data, the latter program includes a color graphics world map display that clearly indicates the sub-satellite points for all selected amateur spacecraft. Several hundred copies of those programs have been delivered through the AMSAT Software Exchange for the mutual benefit of numerous computer owners and our entire organization

February 16, 1983 was the start of a long run of nice days! 73, John, W6SP

*6202 Lochvale Dr.
Rancho Palos Verdes, CA 90274

de K2UBC
continued from page 10

tions using the sample BASIC programs that come with your computer. If you do this while waiting for your tracking program to arrive in the mail you'll save a great deal of frustration.

When your program does arrive, immediately place a write-protect tab on it so that it can't be accidentally erased. This is your master copy. Next, make a copy (your working copy) for day-to-day operation and place the master copy in a safe place. Use the DOS command 'DIR' command to obtain a list (directory) of the programs on the disk. If you see a program name that ends in '.doc' (e.g., manual.doc or, in this case, satellit.doc) or looks similar to 'read.me', print it out on the monitor using the DOS command 'TYPE'. You will see the instructions fly by. Once you've confirmed that you've located the manual, instruct the printer to echo the monitor and then use the TYPE command again. This time you'll get a printed copy of the instruction manual that will tell you what to do next.

The procedure just described works with almost all noncommerical programs designed for widespread distribution. The first time you use such a program the trip is a little rocky but the procedure for adopting new programs quickly becomes routine.

No program like this is ever in its final form. Many users, including WØSL, have already customized it for their own equipment and needs by adding features such as: different colors for different satellites, a ground track memory that can be toggled on and off, an acquisition circle that travels along with the spacecraft, a zoom feature on the graphics, etc. If there's sufficient interest and someone willing to take on the responsibility, it may be possible to add a regular feature on new tracking software and software updates to Satellite Journal. If you'd like to see that happen, a short note to the editor, Harold Winard, is in order.

Congratulations to WØSL on a superb job!

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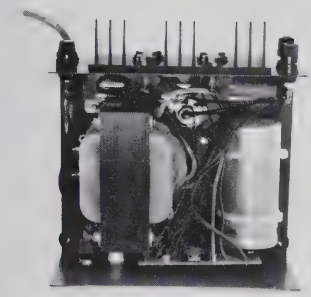

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RM-50A	37	50	5¼ × 19 × 12½	50
• SEPARATE VOLT & AMP METERS				
RM-35M	25	35	5¼ × 19 × 12½	38
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RS-4A	3	4	3¾ x 6½ x 9	5
RS-7A	5	7	3¾ x 6½ x 9	9
RS-7B	5	7	4 × 7½ × 10¾	10
RS-10A	7.5	10	4 x 7½ x 10¾	11
RS-12A	9	12	4½ x 8 x 9	13
RS-20A	16	20	5 x 9 x 10½	18
RS-35A	25	35	5 x 11 x 11	27
RS-50A	37	50	6 x 13¾ x 11	46

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MODEL RS-35M

• Switchable volt and Amp meter

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt (lbs)
RS-12M	9	12	4½ x 8 x 9	13
RS-20M	16	20	5 x 9 x 10½	18
RS-35M	25	35	5 x 11 x 11	27
RS-50M	37	50	6 x 13¾ x 11	46

VS-M SERIES

MODEL VS-20M

- Seperate Volt and Amp Meters
- Output Voltage adjustable from 2-15 volts
- Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H x W x D	Shipping Wt (lbs)
VS-20M	16	9	4	20	5 x 9 x 10½	20
VS-35M	25	15	7	35	5 x 11 x 11	29
VS-50M	37	22	10	50	6 x 13¾ x 11	46

RS-S SERIES

MODEL RS-12S

• Built in speaker

MODEL	Continous Duty (Amps)	ICS* Amps	Size (IN) H x W x D	Shipping Wt (lbs)
RS-7S	5	7	4 x 7½ x 10¾	10
RS-10S	7.5	10	4 x 7½ x 10¾	12
RS-10L(For LTR)	7.5	10	4 × 9 × 13	13
RS-12S	9	12	4½ x 8 x 9	13
RS-20S	16	20	5 x 9 x 10½	18

0, VO1, 2, and VY1). DX stations, including KH6, must contact four different call areas. The application fee is $1 for W/VW stations or four International Reply Coupons (IRCs) for DX stations. Extra postage should be included for registered mail return of the cards and award. Send cards and certificate request to Ray J. Nadeau, VE6SF, Committee Chairman, P.O. Box 52, Barrhead, Alberta T0G 0E0, Canada.

AMSAT sponsors three progressively more difficult satellite operating awards. They include the AMSAT OSCAR Award (AOA), the OSCAR Sexagesimal Award (OSA), and the OSCAR Century Award (OCA). They are presented for confirmation of 20, 60, and 100 QSO-elements respectively. The counting unit is defined as confirmed satellite contacts with different states, Canadian call areas, or countries. A service charge of $3.50 per certification for AMSAT members ($5.00 for non-members) should be sent with cards and return postage to the AMSAT Awards Manager at the Washington, DC address. Endorsement stickers for 10 QSO-element intervals between awards are also available at no extra charge.

Another ARRL satellite award is Worked All States (WAS) via satellite. It is available for contacts via any amateur radio satellite. The form of the award parallels the standard WAS rules. Send an SASE to the ARRL for the appropriate application form and rules listing.

Two of the most difficult awards via satellite are the CQ CW DX Award with OSCAR endorsement and the CQ SSB DC Award with OSCAR endorsement. After achieving the basic awards for 100 countries, the OSCAR endorsement can be requested for 50 countries confirmed via amateur satellites. To get all the necessary award requirements and fee schedules, send for the CQ DX rules sheet from CQ Magazine, 76 North Broadway, Hicksville, NY 11801.

It has been a little over six years since Ben Stevenson, W2BXA, was awarded the first satellite DXCC. Due to the low orbits of the ham satellites of 1979, station locations was a factor in getting this award. Today, it's not uncommon to hear of a three-way rag chew on OSCAR-10 between stations in Oregon, Argentina, and South Africa. The rules for satellite DXCC are the same as those for the standard award. However, there are no endorsement stickers available for contacts beyond the basic award for 100 countries. For the satellite DXCC award you will need ARRL forms CD-164 and CD-253, available from the League. Include an envelope with two units of postage.

Finally, there are many regional U.S. awards and foreign offerings. New awards from AMSAT may include one for mobile communications via satellite and another for gateway operations. So, make those contacts, stock up on picture frames, and clear some wall space.

* *2310 Romayor Court*
Pearland, TX 77581

Balloon-carried transponders relay ground-based signals

Amateur radio takes to the air, literally, in high-flying transponders that could test future AMSAT space hardware.

by Julian Macassey, N6ARE*

During the 1970s in Europe, there were many VHF/UHF transponders of the Mode B type launched from balloons. Most of those were launched by the Germans and had the acronym ARTOB, for Amateur Radio Transponder On Balloon. The French and Italian amateur communities have also launched these devices. ARTOBs were usually launched early on Sunday mornings and reached a good workable height by breakfast time, providing an excellent excuse not to do the gardening.

In the 1980s, it is worth taking another look at ARTOBs, even though we will shortly have polar orbiting satellites carrying packet store-and-forward capabilities as well as high-orbit satellites capable of covering half the world and providing superb DX. At first glance proposing a short term transponder lashing about in the jet stream 70 thousand feet up seems a retrograde step. However, there are several important advantages.

The first is that a balloon-launched transponder is inexpensive to both build and launch. Normally, the only governmental agency that must be notified for clearance is the local air ministry, such as the FAA in the US. Because scientific and meterological balloons are being launched daily, registration is usually a simple formality.

The simplest ARTOB is a balloon-supported digipeater. Recent experience on the west coast of the U.S. has shown that packet radio is ideally suited for emergency traffic. It handles large amounts of data flawlessly. The Achilles heel of such a system is that it works well locally but bogs down when hitting the CW National Traffic System which handles traffic at a much slower rate.

The equipment for such a set up for a flying digipeater could consist of an ICOM IC-22A, a TAPR TNC2 terminal node controller, two 12-V gel cels, one antenna, one radar reflector, one or more helium-filled balloons, one decent parachute, one ID beacon, and styrofoam for insulation.

Some of the parts, such as the battery and radar reflector, are common to any ARTOB. The transponder hardware is what would change and depending on the complexity of the transponder, the costs would change. For example, the ICOM IC-22A digipeater would cost no more than $300, assuming the 2-meter FM rig is purchased for the project and not donated from the rear of someone's garage.

The ARTOB hardware must withstand the cold of high altitudes and the impact of a parachute landing. Most currently available commercial or home-built equipment, with enough padding and styrofoam, could withstand such a flight. Such is not the case for space hardware, which has to withstand a vacuum, continued radiation, extreme vibration, and wild swings in temperature, all while performing flawlessly for years.

If an ARTOB fails in flight, it is merely minor disapointment. In a few hours it will be back on earth for repairs and battery recharging. At the extreme, any problems observed while a balloon-lauched ARTOB is in flight can be corrected before the next launch. An ARTOB, essentially, is a flying test bed.

The launch requires a charge of helium and, of course, a charge in the batteries. Although helium is not the cheapest of gases, the quantity required for a launch could be paid for with the simple pass of the hat. The sort of quantity that is normally used to fill the balloons at a childs birthday party is all that is required for an ARTOB, and the clown is optional.

A real-time test

AMSAT is constantly considering and trying out new ideas in transponders and antennas. Building hardware to test in the laboratory does give some useful numbers, but putting that same hardware in a balloon-launched vehicle is an excellent field test with the bonus of hundreds of users who can file test reports to supplement the in-flight telemetry and the observations of the designers. In addition, aside from free space itself, the upper atmosphere is the next best thing for antenna testing.

Sending hundreds or thousands of dollars worth of equipment up into the sky requires either deep pockets or a means of recovering the transponder. In addition, thought must be given to precisely where the tranponder returns to earth. If the ARTOB comes down in open country there might be little damage to property but the ARTOB might be difficult to reach. However, in a built-up area property owners might not be happy to know a balloon has just landed on their roof. Indeed, it is hard to wander about a suburban neighborhood trying not to look suspicious.

For purposes of retrieval, each ARTOB can carry an ID beacon on a known frequency. The beacon could also carry telemetry. A recovery team made up of avid

direction-finders, or fox hunters could maintain bearings on the ARTOB and track the descent. Then field teams could take over for ground recovery. That would add a new dimension to fox hunts since the target would be moving. The final resting point could be anywhere in a several hundred kilometer radius. Special certificates could be awarded to the successful recovery team or individual. Civil Air Patrol types might also be interested in locating a downed ARTOB since it would closely model a downed aircraft with an emergency locator transmitter (ELT). As with regular transmitter hunts, there could be awards and cerificates to the successful location and recovery teams.

Besides the usual weather radiosonde data that could be gathered by an ARTOB for use by a weather bureau, any group or individual interested in upper atmosphere measurements could hitch a ride to use AMSAT expertise in the collection of data by telemetry. With all the current excitement about acid rain, the greenhouse effect, and upper atmospheric dust and smoke, there might be many groups interested in taking measurements from a balloon.

AMSAT benefits

For AMSAT, there are times when a new transponder design might need testing. For example, an improved AGC system might need checking, and the only way to check it out dynamically is with hundreds of signals of different levels pouring through it. AMSAT could fly a breadboard prototype before continuing with the expensive work of preparing space flight hardware. The same can be said of most of the parts of an increasingly more complex modern amateur satellite.

Every field day, hundreds of amateurs find out about the amateur space program by wandering past the OSCAR tent. There a lonely ham sits at a card table covered with strange boxes. A couple of funny looking antennas, stuck on a short pole outside the tent, points up at an acute angle. The passerby discovers that this is the OSCAR field day effort and that the group has just worked six new countries even though 20 meters has been closed for hours.

Each field day or other large contest, AMSAT could launch an ARTOB to enable more contacts and gain further publicity and good will for the organization and the amateur satellite program. With the cooperation of the contest organizer, there could be extra points awarded for working via the ARTOB.

By launching ARTOBs, the coverage of an area can be greatly extended. The ARTOB could be of varying levels of sophistication, the lowest level being a single simplex-channel FM digipeater. The next would be a single-channel FM store-and-forward device, a flying bulletin-board system. The top-of-the-line model could be a multi-channel transponder enabling several stations to work at high speed, with different channels set aside for various classes of traffic.

Experience will help develop a set of standards for reliable ARTOB operation, such as battery types, balloon specifications, etc., although the whole purpose of the program is experimentation. If no two ARTOBS are ever the same, there can still be great benefits in what can be learned from the efforts. If a group decides to get into building space hardware, the best entry point is to build an ARTOB and learn the engineering problems.

The ARTOB program is in no way intended to replace any existing programs. The main role for AMSAT could be to provide assistance, liason, and coordination. Any group building balloon-launched equipment could use AMSAT for help if they wish and AMSAT could act as the clearing house. Any group would be well advised to contact AMSAT first since they would have information available on the activities of other groups and be able to describe previously-encountered problems and their solution.

There could be an ARTOB manager within AMSAT who would have the task of knowing everyone and everything to do with balloons and what is being hung from them. He would also handle launch publicity on a national and international basis.

If you have experience or information about similar devices or programs, or if you would like to get started on an ARTOB program, please contact the author.

**475 North Daisy Avenue*
Pasadena, CA 91107

Good operating habits make satellites fun

A mixture of good operating tips and common sense reduces interference on the amateur satellite passbands.

by Ron Dittmer, WH6AMX*

From time to time, articles appear that re-emphasize the need for mutual cooperation of all satellite operators to maximize the benefits of our precious resources—the satellites. If this cooperation does not take place, then we all suffer in the long run.

Because of the growing numbers of new satellite operators, it is again time to restate some general principles or rules that we need to put into practice (if not already) as part of our satellite operating habits. It is true that these rules are not binding by law. They are, in fact, gentlemen's agreements that I am sure all of us in the amateur satellite community can live up to.

I would first like to present general operating practices that can be applied to all satellites to maximize everyone's operating enjoyment:

1. The first principle, and one of the most important, is to maximize your receive capabilities. If you are having difficulty copying your own downlink signal and those of others, consider improving the receive system instead of adding more transmit power to your system. Increasing power on a satellite transponder takes away from the ability of the weaker low-power stations to access the satellite. There is no need to run any more power than what is necessary to bring your signal up to the level of the beacon transmissions. Your signal should never be stronger than the beacon. Consider low-loss coaxial lines, bigger antennas, or preamplifiers.

2. Secondly, use a passband frequency guide to approximate your transmit frequency. Do not recklessly swish your transmitter VFO around trying to find your downlink signal. That creates an unnecessary nuisance to operators trying to carry on a conversation. Conversion tables are available from back issues of *Orbit, Amateur Satellite Report,* and *QST.* If you are unable to obtain a copy, write to AMSAT, P.O. Box 27, Washington, DC 20044 for a copy.

3. Monitor your downlink signal for a quality check. If you notice problems, check them out. Do not continue operating with known difficulties. One other common problem, especially on AMSAT-OSCAR-10, is the annoying feedback or echo that mixes with the signal coming from the speaker. If not annoying, it sometimes disrupts communications altogether. One way to handle the problem is to either turn down the volume of the receiver while you are transmitting or use headphones.

4. For those who like to chase DX, pileups are an exercise in futility. Don't continue to push up your power to get on top of the pile. Move off frequency for calls. Most DX stations are looking above and below their transmit frequency for calls. There is no need for everyone to get on the station's transmit frequency and see who can run the most power. By increasing your power you will defeat your purpose when you eventually wipe the DX station from the transponder if he is running relatively low power.

Guidelines for OSCAR-10

Besides the general satellite principles, the following specific guidelines apply to OSCAR-10 operation:

1. QRP day is still on Mondays (UTC). QRP means a maximum power output of from 50 to 100 W ERP. That is calculated by multiplying the power at the antenna feedpoint by the antenna gain. For example, 10 W − 10 dB = 100 W ERP (acceptable) or 50 W − 10 dB = 500 W ERP (unacceptable).

2. OSCAR-10 has five frequency segments reserved for special activities. Four of those segments are known as Special Services Channels (SCC) and are available on a by-reservation basis. The SSCs are set aside for special activities, such as regularly broadcast amateur radio bulletins, educational experiments, packet radio activities, as well as other projects. If you have a worthwhile project—educational or research—you can make use of the frequency with prior coordination with one of the SSC coordinators. Prior permission is essential to avoid conflicts with programs already underway. Everyone should stay clear of the SSC channels to available interference with scheduled activities. Some of the channels are

SSC L1 145.830 MHz Packet radio

SSC L2 145.840 MHz CW/RTTY bulletins and experiments

SSC H2 145.962 MHz Voice - Educational and scientific use

SSC H1 145.972 MHz Voice - Bulletins

The fifth frequency segment is the AMSAT Calling and Net Frequency (ACNF). That frequency—145.957 MHz—is set aside as a common gathering spot for satellite information nets, area coordinator activities, and for getting in touch with AMSAT officials. Unlike the other SSCs, the ACNF is not under strict control. However, it is appreciated if users would keep clear of the frequency when it is not being used for the intended purposes.

The set of rules serve as a guide for courteous operation on all the amateur radio satellites. Since the launch of OSCAR-10, there has been an amazing increase in the size of the amateur satellite community. Because of the growing numbers the guidelines are even more important than ever and should be re-emphasized from time to time.

Not every satellite operator will see this article so it is left to you—the informed—to educate the others in the proper operating guidelines. In the same context, many non-satellite operators are working terrestrial communications in the satellite passbands. They may not be aware of what their activities are doing to the satellite community so is again up to all of us to educate those people (in a courteous way of course) to the existence of the passbands and the consequences of their activities. I am sure that they would be more than willing to cooperate if informed. It is with the cooperation of all of us that we will have many enjoyable years of satellite operation.

**7305D Aloalo Street Honolulu, HI 96818*

AMSAT NEWS

Phase 4 proposals take shape

Several projects are underway that could lead to geosynchronous amateur radio capability. The first involves the use of a transponder aboard a National Aeronautics and Space Administration (NASA) spacecraft called ACTS, or Advanced Communications Technology Satellite. Although the 30/20-GHz uplink/downlink combination and the very high-speed digital switching required would tax technical resources, AMSAT is forming a study group to work on a proposal for what is being described as the Phase 4A, Option 1.

A second possibility is for an AMSAT tranponder on board a 1988 ACTS launch. A preliminary proposal might include a Mode L and Mode S tranponder that would take advantage of the conditioned power, station-keeping, and thermal control of the host spacecraft. According to AMSAT vice president for engineering, Jan King, W3GEY, a key incentive for including AMSAT aboard ACTS would be for NASA to perceive a positive technical innovation and/or public service aspect to an AMSAT proposal.

According to King, three types of service are possible from an ACTS transponder. The first would be a Mode L linear trasnponder similar to that on AMSAT-OSCAR-10 and the Phase IIIC spacecrafts. Second would be a packet radio repeater or packet switch. The third service might include the capability of linking selected terrestrial repeaters and group-address repeaters for bulletins, training, educational materials, and emergency communications. A C-band transponder is also being considered.

AMSAT is soliciting proposals for use of a possible ACTS transponder, the Phase 4A, Option 2. Comments should be sent to AMSAT, P.O. Box 177, Warwick, NY 10990.

The third geosynchronous possibility centers on the Ariane 4 launch vehicle. Arianespace is working on a low-cost piggy-back systems that seems suited to carry a two-satellite system into a geosynchronous transfer ellipse. One satellite could be positioned over 148 degrees west to provide coverage of virtually all of North America to western Europe and most of Africa. The second spacecraft would provide coverage of most of North America to the Pacific basin, including New Zealand, eastern Australia, and Japan. A terrestrial relay could link the two satellites for double-hop communications from, say, England to Australia. The two-satellite system is being called Phase 4A, Option 3.

Parise to fly shuttle next March

Ron Parise, WA4SIR, has been selected by NASA to fly the Astro 1 space shuttle mission next March. Ron is an AMSAT member and was formerly AMSAT UoSAT Science Advisor.

The selection for Astro 1 means a nominal liftoff aboard mission 61E on March 6, 1986. Parise designed and will operate some of the unique astronomical instruments aboard Astro 1. One of those instruments, the Ritchie-Chretian ultraviolet telescope, may give a glimpse at Halley's comet.

A proposal to place a packet radio terminal node controller (TNC) aboard the flight is being developed by a group in the Washington, DC area. According to former AMSAT president Tom Clark, W3IWI, some hardware is now coming together. Plans call for a special version of the Tucson Amateur Packet Radio (TAPR) TNC-2.

Mode L experiments test Phase 4 concept

According to AMSAT president Vern Riportella, WA2LQQ, experiments will begin this fall to test the feasibility of using the Mode L tranponder aboard OSCAR-10 for distribution of bulletins. A high-power Mode-L station is being assembled at WA2LQQ and experiments are planned using FM and amplitude-compandored single sideband (ACSSB) as well as conventional sideband transmissions.

Part of the experiment might include use of receive-only down-converters for use by terrestrial VHF and UHF repeaters for retransmission of bulletins.

UoSAT telemetry software available

A newly-developed program for decoding UoSAT telemetry is available from the AMSAT Software Exchange, P.O. Box 27, Washington, DC 20044. The software was written by Bob Diersing, N5AHD, and will run on the IBM PC.

T-shirts commemorate SAREX

New T-shirts, available from AMSAT headquarters, commemorate the flight of WØORE aboard the orbiter Challenger. Featured on the light-blue shirt is an illustration of space shuttle mission 51F. Included are SAREX, the Shuttle Amateur Radio Experiment, plus the AMSAT, ARRL, and NASA logos. The shirts are available in small, medium, large, and extra-large sizes. Please specify. Contact AMSAT, 850 Sligo Ave., Silver Spring, MD 20910 or call (301) 589-6062.

Young Astronauts seek hams

The Young Astromauts Program (YAP) is seeking hams around the country who can perform live space communications demonstrations for younsters in the 6-to-14 age group. Demonstrations of OSCAR communications as well as EME contacts are particularly desired. For more information, contact Bill Lazzaro, N2CF, at the American Radio Relay League office in Washington, DC. (202) 429-9748.

25th Anniversay celebration planned

AMSAT is looking for ideas on how best to celebrate the 25th anniversary of the launch of OSCAR 1. A series of special commemorative events is contemplated for next year, as is a 25th anniversary yearbook.

Orbital Elements

Satellite:		**oscar-9**	
Catalog number:		12888	
Epoch time:		85276.41448399	
	Thu Oct 3	09:56:51.416	1985 UTC
Element set:		799	
Inclination:		97.6414	deg
RA of node:		266.6496	deg
Eccentricity:		0.0001081	
Arg of perigee:		212.6663	deg
Mean anomaly:		147.4512	deg
Mean motion:		15.27626729	rev/day
Decay rate:		1.126e-05	rev/day'2
Epoch rev:		22175	
Semi major axis:		6858.011	km
Anom period:		94.263865	min
Apogee:		486.727	km
Perigee:		485.245	km
Ref perigee:		2832.38767203	
	Thu Oct 3	09:18:14.863	1985 UTC
Beacon:		145.8250	MHz
Satellite:		**oscar-10**	
Catalog number:		14129	
Epoch time:		85275.85372603	
	Wed Oct 2	20:29:21.928	1985 UTC
Element set:		205	
Inclination:		26.2273	deg
RA of node:		116.0561	deg
Eccentricity:		0.5965246	
Arg of perigee:		50.5133	deg
Mean anomaly:		348.9904	deg
Mean motion:		2.05856198	rev/day
Decay rate:		-4.8e-07	rev/day'2
Epoch rev:		1735	
Semi major axis:		26105.451	km
Anom period:		699.517437	min
Apogee:		35302.337	km
Perigee:		4157.250	km
Ref perigee:		2831.86858214	
	Wed Oct 2	20:50:45.496	1985 UTC
Translate freq:		581.0047	MHz
Invert:		1	
Beacon:		145.8100	MHz
Satellite:		**oscar-11**	
Catalog number:		14781	
Epoch time:		85275.71454271	
	Wed Oct 2	17:08:56.490	1985 UTC
Element set:		89	
Inclination:		98.1810	deg
RA of node:		340.8135	deg
Eccentricity:		0.0012070	
Arg of perigee:		250.2792	deg
Mean anomaly:		109.7087	deg
Mean motion:		14.61994195	rev/day
Decay rate:		8e-07	rev/day'2
Epoch rev:		8474	
Semi major axis:		7061.956	km
Anom period:		98.495603	min
Apogee:		710.901	km
Perigee:		693.854	km
Ref perigee:		2831.69369814	
	Wed Oct 2	16:38:55.519	1985 UTC
Beacon:		145.8260	MHz
Satellite:		**RS-5**	
Catalog number:		12999	
Epoch time:		85272.36987969	
	Sun Sep 29	08:52:37.605	1985 UTC
Element set:		267	
Inclination:		82.9525	deg
RA of node:		248.3138	deg
Eccentricity:		0.0007975	
Arg of perigee:		209.7411	deg
Mean anomaly:		150.3195	deg
Mean motion:		12.05049503	rev/day
Decay rate:		4e-08	rev/day'2
Epoch rev:		16645	
Semi major axis:		8033.857	km
Anom period:		119.497166	min
Apogee:		1667.303	km
Perigee:		1654.489	km
Ref perigee:		2828.33522932	
	Sun Sep 29	08:02:43.812	1985 UTC

Satellite:		**RS-7**	
Catalog number:		13001	
Epoch time:		85274.01345740	
	Tue Oct 1	00:19:22.719	1985 UTC
Element set:		218	
Inclination:		82.9550	deg
RA of node:		242.0455	deg
Eccentricity:		0.0022494	
Arg of perigee:		134.9399	deg
Mean anomaly:		225.3514	deg
Mean motion:		12.08694756	rev/day
Decay rate:		3e-08	rev/day'2
Epoch rev:		16715	
Semi major axis:		8017.686	km
Anom period:		119.136779	min
Apogee:		1668.130	km
Perigee:		1632.060	km
Ref perigee:		2830.04440185	
	Tue Oct 1	01:03:56.319	1985 UTC
Satellite:		**RS-8**	
Catalog number:		12998	
Epoch time:		85274.03973838	
	Tue Oct 1	00:57:13.396	1985 UTC
Element set:		341	
Inclination:		82.9531	deg
RA of node:		250.3508	deg
Eccentricity:		0.0017936	
Arg of perigee:		273.3515	deg
Mean anomaly:		86.5464	deg
Mean motion:		12.02955854	rev/day
Decay rate:		4e-08	rev/day'2
Epoch rev:		16636	
Semi major axis:		8043.182	km
Anom period:		119.705141	min
Apogee:		1700.455	km
Perigee:		1671.602	km
Ref perigee:		2830.01975372	
00:28:26.721		Tue Oct 1	1985 UTC
Satellite:		**NOAA-8**	
Catalog number:		13923	
Epoch time:		85257.38501718	
	Sat Sep 14	09:14:25.484	1985 UTC
Element set:		117	
Inclination:		98.6591	deg
RA of node:		287.6163	deg
Eccentricity:		0.0016697	
Arg of perigee:		175.4269	deg
Mean anomaly:		184.7063	deg
Mean motion:		14.22470367	rev/day
Decay rate:		6.1e-07	rev/day'2
Epoch rev:		12804	
Semi major axis:		7192.300	km
Anom period:		101.232337	min
Apogee:		826.297	km
Perigee:		802.279	km
Ref perigee:		2813.41924826	
	Sat Sep 14		
		10:03:43.49	1985 UTC
Beacon:		137.5000	MHz
Satellite:		**NOAA-9**	
Catalog number:		15427	
Epoch time:		85262.22641727	
	Thu Sep 19	05:26:02.452	1985 UTC
Element set:		37	
Inclination:		98.9553	deg
RA of node:		215.7717	deg
Eccentricity:		0.0014817	
Arg of perigee:		194.3161	deg
Mean anomaly:		165.7587	deg
Mean motion:		14.11381042	rev/day
Decay rate:		1.2e-06	rev/day'2
Epoch rev:		3960	
Semi major axis:		7229.968	km
Anom period:		102.027727	min
Apogee:		863.812	km
Perigee:		842.386	km
Ref perigee:		2818.19379385	
	Thu Sep 19	04:39:03.788	1985 UTC
Beacon:		137.5000	MHz

Via Phil Karn, KA9Q

PACKET EVOLUTION

From $219.95 Suggested amateur net price.

ANOTHER BREAKTHROUGH FROM AEA

Packet + RTTY= Pakratt™ PK-64.

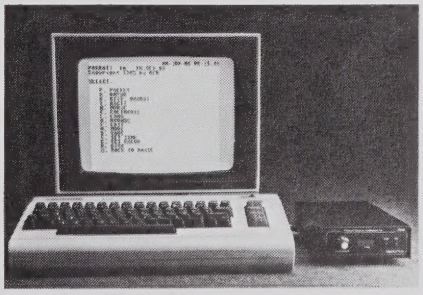
If you 've read about packet, or are already into it, you know how exciting it is. With the hot new Pakratt PK-64 we've just brought a new dimension to packet. The Pakratt PK-64 is a complete, fully assembled and tested packet radio controller which, together with a Commodore 64 or 128 computer, can convert your shack into a packet operations center.
And we've included a new version of our advanced MBA-TOR™ software to make it the first packet controller with AMTOR, Baudot, ASCII and Morse. But an even more exciting part of the Pakratt controller is its great price.

Incredibly Simple To Set Up

Just plug the Pakratt controller into the C-64's game cartridge slot, add a mic connector for connecting to your particular transceiver, and you're set.
If you're anxious to try it out, our new "quickstart" manual section can get you on the air in under ½ hour.

Simply Powerful

The versatile Pakratt controller shows messages and connect status simultaneously on your Commodore with a unique split-screen display. And it lets you



PK-64 shown with HF modem option.
Computer not included.

send letter-perfect text from the text editor software while monitoring incoming messages. The 20K byte QSO buffer stores more than 20 video screens of text! Disk commands let you save specific operating parameters for quick set-up for emergency services, clubs, and multiple frequency use. And the Pakratt controller's standard, TAPR style modem gives you 300 and 1200 baud operation with great HF/VHF performance.

We can't possibly list all of the important features of Pakratt here. But the absolutely best part of the Pakratt PK-64 is that it's at your dealer now. So stop reading, run down to your local dealer, and check Pakratt out. Because the real challenge will be to find one after the other hams see it.

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TR-9130

TR-9130 2 meter all mode

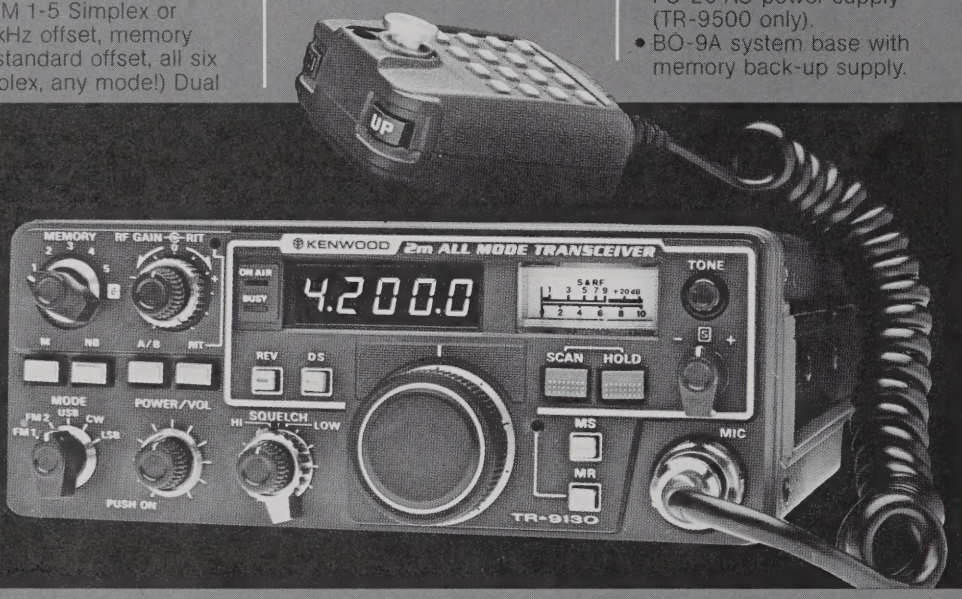
The TR-9130 is a compact rig that gives you 25 watts of RF power on all modes!! You can select your tuning steps from 100-Hz, 1-kHz, 5-kHz or 10-kHz. With six memories, you can program your favorite frequencies! (FM 1-5 Simplex or ±600-kHz offset, memory 6 non-standard offset, all six for simplex, any mode!) Dual digital VFO's, and transmit frequency tuning enhance OSCAR operations.

Internal battery back-up (9 V Ni-Cd not Kenwood supplied) retains memories for approximately 24 hours, in case you operate mobile and base!

Other convenient features such as automatic band scan, squelch circuit for FM/SSB/CW, tone switch, repeater reverse switch, CW semi break-in; sidetone, high performance noise blanker HI (25) LOW (5) power switch (FM/CW) RF gain control, and RIT circuit further enhance this expressive package!

Optional accessories:

- KPS-7A AC power supply.
- PS-20 AC power supply (TR-9500 only).
- BO-9A system base with memory back-up supply.
- SP-120 external speaker.
- TK-1 AC adapter for memory back-up.
- SP-40 mobile speaker.
- SP-50 mobile speaker.
- SW-100 A/B power meters.
- MC-55 Mobile Mic w/time-out timer.



TR-9500

70 CM SSB/CW/FM transceiver

- Covers 430-440 MHz, in steps of 100-Hz, 1-kHz, 5-kHz, 25-kHz or 1-MHz.
- CW-FM Hi—10 W, Low—1 W. SSB 10 W.
- Automatic band/memory scan. Search of selected 10-kHz segments on SSB/CW.
- 6 memory channels.

TS-711A/TS-811A

Multi-function all-mode 2 m and 70 cm transceivers.

The TS-711A 2 m (142-149 MHz) and TS-811A 70 cm (430-450 MHz) all-mode transceivers are perfect base station units, designed to complement your present HF station. Both feature Kenwood's innovative D.C.S. circuitry. Built-in dual digital VFO's provide commercial-grade frequency stability through the use of a TCXO (Temperature Compensated Crystal Oscillator). The new fluorescent multi-function display shows frequency, RIT shift, VFO A/B, SPLIT, ALERT, repeater offset, digital code, call sign code, and memory channel. 40 multi-function memories store frequency, mode, repeater offset and tone. They have programmable scan, memory scan, and mode scan. The Auto-mode function automatically selects the correct mode for the frequency being used. When a mode key is depressed, an audible "beeper" announces mode identification in International Morse Code.

The TS-711A/TS-811A also feature all-mode squelch, noise blanker, speech processor (SSB, FM), IF shift, RF power control, alert, and a unique channel Quick-Step tuning that varies tuning characteristics from conventional VFO feel, to stepping action when CH.Q switch is depressed.

Combine all these features with built-in AC power supply and a hefty 25 watts RF output power and you have your ideal base station.

Optional accessories:

- CD-10 Call sign Display
- TU-5 CTCSS Tone Unit • VS-1 Voice Synthesizer • MC-60A Deluxe Desk Mic • MC-80 Desk Mic • MC-85 Desk Mic
- SP-430 External Speakers
- MB-430 Mobile Mount
- PG-2J DC Cable